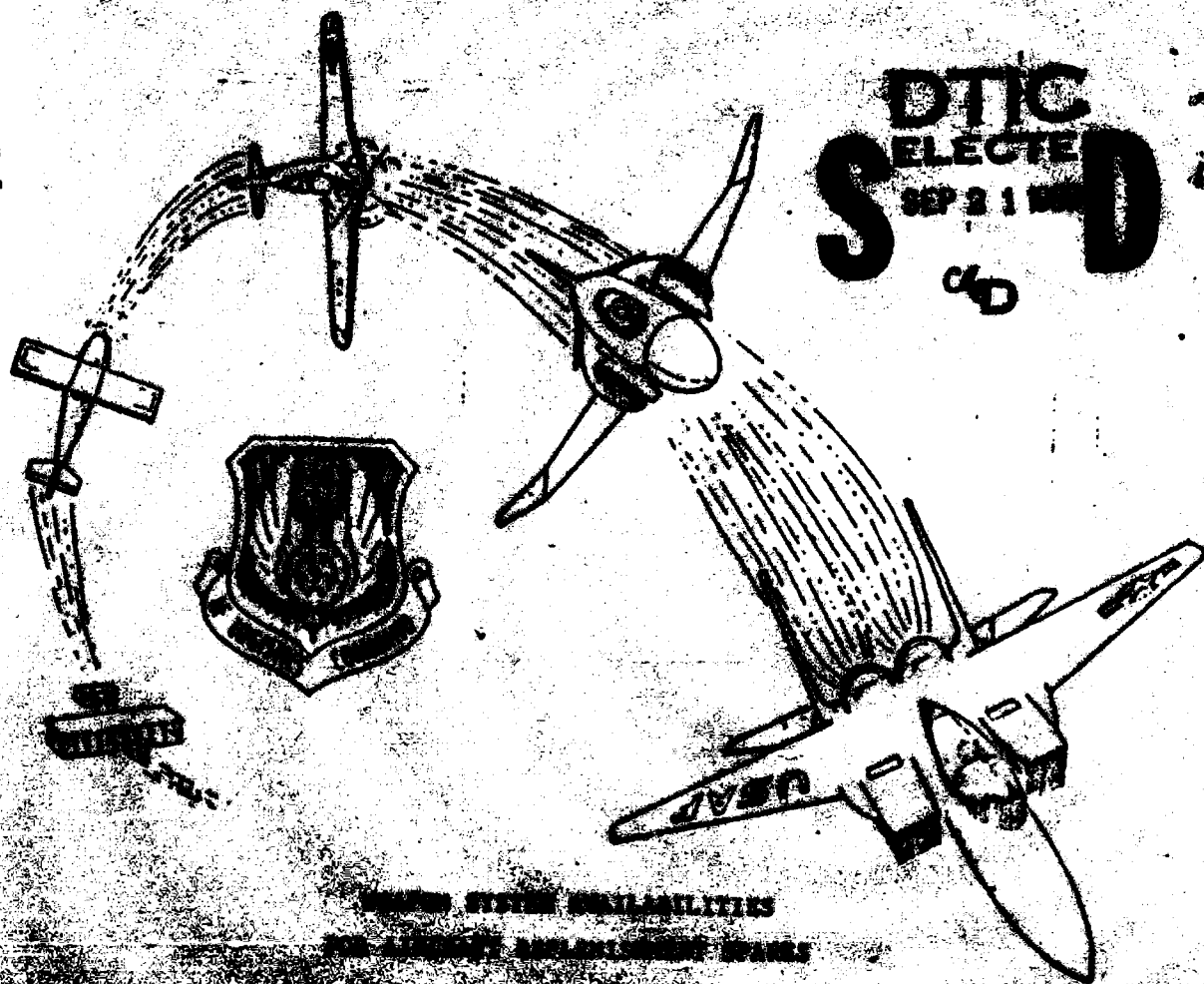


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AIR FORCE LOGISTICS COMMAND
MATERIAL ANALYSIS



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DEPARTMENT OF THE AIR FORCE
HEADQUARTERS AIR FORCE LOGISTICS COMMAND
WRIGHT-PATTERSON AIR FORCE BASE, OHIO 45433-5001

26 AUG 1988

REPLY TO
ATTN OF MMM

SUBJECT Aircraft Availability Model (AAM) Weapon System Availability Targets

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1. HQ AFLC will implement the Aircraft Availability Model (AAM) to compute peacetime aircraft replenishment spares requirements (Budget Program 15). The AAM computes spares requirements to achieve weapon system availability targets at the least cost. The AAM includes common items and ensures common items support each weapon system availability target. We've just completed our analysis to develop a smart methodology for setting aircraft availability targets. Attached is the final report which includes recommended weapon system targets for the initial AAM implementation and a method to set future targets.

2. Our report shows how we determined AAM weapon system availabilities to optimize the Air Force aircraft availability readiness position at a requirements cost equal to that of the current Variable Safety Level (VSL) model. We found AAM costs equalled VSL costs when AAM targets were set at the higher of 82.5 percent or the VSL availability level. Using the 82.5 percent target as the starting point we optimized weapon system availabilities within weapon system groupings (tactical, strategic, airlift, and trainers), keeping the total costs constant. In the tradeoff we didn't allow individual weapon system availabilities to increase above 90 percent or fall below 75 percent, and we only traded off down to 98 percent of VSL dollars.

3. As a result, we were able to redistribute dollars within a narrow band, preventing drastic changes to today's allocations while maximizing the number of available aircraft. At an equal cost to today's requirements, the resulting AAM availability targets achieve an Air Force average aircraft availability of 84.7 percent, compared to only 66.4 percent average availability under VSL.

4. We've briefed our analysis to Air Staff and the major commands at several conferences. All have agreed to our approach and the resulting targets contained in our report. We plan to implement these availability targets in AAM and continue to use our proposed methodology to set future AAM weapon system targets. Our point of contact is Capt Tim Sakulich, HQ AFLC/MMAA, AUTOVON 787-4139.

FOR THE COMMANDER

Marvin L. Davis
MARVIN L. DAVIS, Colonel, USAF
Director, Materiel Requirements
and Financial Management
DCS/Materiel Management

- 2 Atch
1. Conclusions and Actions
2. Final Report

Conclusions and Actions

Conclusions

1. The Aircraft Availability Model (AAM) optimizes spares requirements to achieve target weapon system availabilities at the least cost. It also relates dollars to readiness and accounts for the impact of common-items.
2. We've programmed a methodology that sets weapon system targets which achieve aircraft availability at least equal to today's availabilities, maximizes the number of aircraft by weapon system category (tactical, bomber/tanker, airlift, and trainers), and does not drastically alter the allocation of dollars under the current Variable Safety Level (VSL) computation.
3. We can achieve 84.7 percent average aircraft availability with AAM for the same cost to achieve 66.4 percent average aircraft availability with VSL.
4. We can automate the methodology for determining optimal weapon system availability targets for both full funding and dollar-constrained computations.
5. We've briefed the major commands on our proposed methodology to set weapon system targets and they agree with our approach.

Actions

1. Implement the Aircraft Availability Model (AAM) to compute peacetime requirements for aircraft replenishment spares. (OPR: HQ AFLC/MMMR)
2. Use the AAM weapon system availability targets specified in Appendix A of this report of the June 1988 AAM computation. (OPR: HQ AFLC/MM)
3. Automate down loading cost-versus-availability tables from the AAM production system. (OPR: AFLC LMSC/SMP, OCR: HQ AFLC/MMMR)
4. Implement the personal computer-based system for determining optimal weapon system availability targets. (OPR: HQ AFLC/MMM(3))
5. Use our methodology to determine dollar-constrained weapon system targets. (OPR: HQ AFLC/MMM(2), OCR: HQ AFLC/MMMA)
6. Investigate using our optimization methodology to determine War Readiness Spares Kit (WRSK) and Base Level Self-Sufficiency Spares (BLSS) limited funding targets. (OPR: HQ AFLC/MMMA, OCR: HQ AFLC/MMM(2)/MMM(3))
7. Investigate using our optimization methodology to determine Other War Reserve Materiel (OWRM) limited funding weapon system targets. (OPR: HQ AFLC/MMM(4), OCR: HQ AFLC/MMM(2)/MMM(3))
8. Investigate appropriate methods for weighing weapon systems in the optimization tradeoffs. (OPR: HQ AFLC/MMMA)

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to the Force registers Command was to be implemented

ABSTRACT

AFPC will implement the Aircraft Availability Model (AAM) in June 1988 to compute peacetime safety levels for aircraft replenishment spares (Budget Program 15). AAM computes requirements to achieve weapon system availability targets. ~~In this study, we develop~~ weapon system availability targets for the AAM. We picked the targets to maximize the Air Force aircraft availability readiness position, within weapon system groupings of tactical, strategic, airlift and trainers aircraft. Using these targets, AAM achieves higher aircraft availabilities for the same total cost as the current system. The AAM targets achieve between 75 and 90 percent availability for every weapon system (except in cases where the current system achieved higher than 90 percent availability for a weapon system, in which case we assign targets equal to the current support levels). These AAM targets achieve an average Air Force aircraft availability of 84.7 percent, compared to 66.4 percent average availability under the current system.

This report also discusses implementation issues, including an automated, user-friendly tool to develop future availability targets for computing requirements and dollar-constrained budget execution. *CR* ←



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EXECUTIVE SUMMARY

Headquarters Air Force Logistics Command will implement the Aircraft Availability Model (AAM) in June 1988 for computing peacetime aircraft replenishment spares requirements (Budget Program 15). AAM computes spares requirements to achieve weapon system availability targets at the least cost. AAM also takes into account the impact of common items on weapon system availabilities. The purpose of this project was to develop a smart methodology for setting aircraft availability targets and to recommend targets for the June 1988 implementation.

Our main constraint in determining initial AAM targets was to optimize weapon system availabilities while keeping the total AAM requirements cost equal to that of the current Variable Safety Level (VSL) model. Another ground rule was to achieve at least 75 percent availability for each weapon system. Finally, we wanted to maximize aircraft availability but we also wanted to prevent drastic changes to funds allocations.

We found AAM costs equalled VSL costs when AAM targets were set at the higher of 82.5 percent or the VSL availability level. Using the 82.5 percent target at the starting point we optimized weapon system availabilities within weapon system groupings (tactical, strategic, airlift and trainers). In the tradeoff we didn't allow individual weapon system availabilities to increase above 90 percent or fall below 75 percent, and we only traded off down to 98 percent of VSL dollars.

The results: We were able to redistribute dollars within a narrow band, preventing drastic changes to today's allocations while maximizing the number of available aircraft. Using the availability targets we develop in this report, AAM will achieve an Air Force average aircraft availability of 84.7 percent, compared to only 66.4 percent average availability under VSL.

We finished our analysis in time for the final test of AAM in March 1988. The major commands have agreed with our approach. We're ready to implement these availability targets in the June 1988 requirements computation.

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Chapter 1

THE PROBLEM

PROBLEM STATEMENT

HQ AFLC will implement the Aircraft Availability Model (AAM) in June 1988 for computing peacetime aircraft replenishment spares requirements (Budget Program 15). **AAM relates dollars to readiness, and optimizes spares requirements to achieve target weapon system availabilities at the least cost. The AAM includes common items and ensures common items support each weapon system availability target.** We need to determine what the AAM weapon system availability targets should be. To do this, we need a methodology to evaluate investment tradeoffs between weapon systems. This will allow the Air Force to set availability targets which yield the best aircraft availability readiness position per dollar.

OBJECTIVES

1. Develop a method to balance weapon system availability goals to achieve the best aircraft availability readiness position per dollar.
2. Develop a user-friendly personal computer-based system for setting weapon systems availability targets.
3. Use the methodology to set weapon system availability targets beginning with the June 1988 computation cycle.

BACKGROUND

In FY88, AFLC will begin using a version of the Logistics Management Institute (LMI) Aircraft Availability Model (AAM) to determine peacetime requirements for aircraft replenishment spares. AAM determines requirements based on weapon system availability targets. Each weapon system target is specified as the percent of the fleet which is not missing any Line Replaceable Units (LRUs). The model achieves each weapon system availability target at the least cost by performing marginal analysis tradeoffs at the item level. In addition, AAM considers the impact of common items during the marginal analysis tradeoff. The model doesn't perform any investment tradeoffs between weapon systems. Currently, AFLC sets weapon system availability targets based on historical funding, Air Staff guidance and "gut feel."

There were two requirements for this study. One was to determine weapon system targets for the March 1988 final test of AAM and for the June 1988 implementation of AAM. The second requirement was to develop an automated methodology to "optimize" weapon system targets for future AAM computations.

Chapter 2

ANALYSIS

OVERVIEW

This chapter describes Air Staff guidance for setting weapon system availability targets, our analysis to determine full funding targets, what's needed to set dollar-constrained targets, how we intend to automate the target setting process, and implementation issues which we must resolve.

AIR STAFF GUIDANCE

Air Staff (AF/LEYS) tasked AFLC to determine full funding weapon system availability goals for the March 1988 AAM requirements computation in the worldwide Recoverable Consumption Item Requirements System (D041). To set the goals, we were to constrain AAM to the same bottom line cost as the current system--the Variable Safety Level (VSL) model. We also needed to ensure every weapon system achieved at least the current VSL availability or 75 percent, whichever was higher.

ANALYSIS TO SET MARCH 1988 TARGETS

We used March 1987 D041 data for 20 major weapon systems as our baseline. These 20 weapon systems account for 98 percent of today's AAM costs. We determined the VSL costs for these systems, and we assessed the VSL stock levels using AAM to determine the current weapon system availabilities (see Appendix A). We determined we'd allocate the same amount as VSL by setting an 82.5 percent target for all 20 weapon systems (except four systems where VSL achieved a higher availability--we set the targets for those systems equal to the VSL availabilities).

We then divided the systems into four groups: 11 tactical aircraft, 5 strategic bomber/tanker aircraft, 3 airlift aircraft, and 1 trainer. We computed the marginal gain in aircraft per dollar for each weapon system. For each group we maximized the total number of aircraft available within the group by reallocating dollars without increasing the total cost. In this tradeoff we used several rules, their purpose being to prevent drastic reallocations of dollars while maximizing available aircraft. The rules:

a. We allocated more money to the system with the largest marginal gain in aircraft per dollar. We allocated less money to the system with the smallest marginal loss in aircraft. Using this technique, we increased the total available aircraft without increasing the total cost.

b. We set a floor of 75 percent and a ceiling of 90 percent availability. Once a weapon system reached the floor or ceiling we excluded that system from further reallocations.

c. During the tradeoff we did not allow the dollar allocation for any system to fall below 98 percent of the VSL allocation. Once a weapon system reached 98 percent of the VSL allocation we excluded that system from further reallocations.

Our tradeoffs optimally reallocated dollars within the above constraints to yield the largest number of available aircraft within each group.

ANALYSIS TOOLS WE USED

To do the analysis we used data generated by the (HQ AFLC/XPSC) Aircraft Availability Model on the Honeywell CREATE system, a PC FORTRAN program, and a PC spreadsheet program. We wrote CREATE software which extracts cost-versus-availability data from the CREATE file system, reformats it and downloads it--along with weapon system fleet size data--to floppy disk. For each weapon system the cost-versus-availability tables relate funding to availability in approximately 1/2 percent availability increments. We wrote a PC MICROSOFT FORTRAN program which reads and displays this data. The PC program computes the marginal gain information and allows the user to adjust individual weapon system targets to reallocate dollars.

We manually "reallocated" the dollars to maximize the available aircraft within each group. Then we built a spreadsheet to summarize the results. Overall, the analysis was a labor-intensive, multi-step process of comparing weapon system availabilities, determining the optimal marginal gain within each group, reallocating dollars, and determining when to exclude a weapon system from further reallocations. However, the analysis validated the concept of setting "smart" weapon system availability targets. **We showed how to set weapon system availability targets which give the best aircraft availability readiness position without drastically changing dollar allocations.**

An example should help. We illustrate the process for the airlift weapon systems. In our analysis this group included the C-5, C-130 and C-141. Table 2-1 shows the current VSL availabilities.

CURRENT VSL AVAILABILITIES FOR
AIRLIFT WEAPON SYSTEMS

<u>Weapon System</u>	<u>Availability</u>	<u>Fleet</u>	<u>Available Aircraft</u>
C-5	38.3 %	114	43.7
C-130	75.1 %	768	576.8
C-141	42.6 %	254	108.2
Total			728.6

Table 2-1

Table 2-2 shows AAM availability for our starting point in the tradeoff.

AAM AVAILABILITIES FOR
AIRLIFT WEAPON SYSTEMS

<u>Weapon System</u>	<u>Availability</u>	<u>Available Aircraft</u>	<u>Costs (\$ Millions)</u>	<u>Marginal Gain in A/C per \$1 Million</u>
C-5	82.6	94.2	722.1	0.284
C-130	82.5	633.6	277.2	4.968
C-140	82.6	209.9	261.6	1.133
Totals		937.7	1260.9	

Table 2-2

The last column of Table 2-2 shows the marginal increase in the number of available aircraft AAM achieves by allocating another \$1 million to each weapon system. We get the largest marginal gain in aircraft by allocating more money to the C-130. The C-5 has the lowest marginal gain in aircraft per \$1 million and therefore the smallest marginal loss in aircraft per \$1 million. Table 2-3 shows what happens when we reallocate \$2.1 million from the C-5 to the C-130.

WEAPON SYSTEM AVAILABILITIES AFTER INITIAL
REALLOCATION OF DOLLARS

<u>Weapon System</u>	<u>Availability</u>	<u>Available Aircraft</u>	<u>Cost (\$ Millions)</u>	<u>Marginal Gain in A/C per \$1 Million</u>
C-5	82.0	93.5	720.0	0.291
C-130	83.9	644.2	279.3	4.865
C-141	82.6	209.9	261.6	1.133
Totals		947.6	1260.9	

Table 2-3

As you can see, we allocate the same total dollars as our starting point. We "lost" 0.7 C-5s but "gained" 10.6 C-130s, for a net increase of nearly 10 aircraft. Continuing the tradeoff we hit the 90 percent availability cap for the C-130 (shown in Table 2-4).

WEAPON SYSTEM AVAILABILITIES AFTER SECOND
REALLOCATION OF DOLLARS

<u>Weapon System</u>	<u>Availability</u>	<u>Available Aircraft</u>	<u>Cost (\$ Millions)</u>	<u>Marginal Gain in A/C per \$1 Million</u>
C-5	79.0	90.1	710.1	0.338
C-130	89.5	687.7	291.1	2.821
C-141	82.6	209.9	261.1	1.133
Totals		987.7	1262.8	

Table 2-4

Barring further increases to the C-130 allocation, this makes the C-141 the next candidate for increased dollars. The C-5 continues to be the least hurt of the three by reducing its allocation. So, we reallocated dollars from the C-5 to the C-130. We continued in this vein until the C-5 reached the 75 percent availability floor. Table 2-5 shows the final allocations.

FINAL WEAPON SYSTEM ALLOCATIONS

<u>Weapon System</u>	<u>Availability</u>	<u>Available Aircraft</u>	<u>Cost (\$ Millions)</u>	<u>Marginal Gain in A/C per \$1 Million</u>
C-5	75.0	85.5	699.0	0.381
C-130	89.5	687.7	291.1	2.821
C-141	87.5	222.2	269.0	0.952
Totals		995.5	1259.0	

Table 2-5

In our tradeoff analysis we kept the total dollars nearly constant and increased available aircraft by 57.8 aircraft (995.5-937.7). Note that after the allocation tradeoff, we still achieve a higher availability than VSL for all three weapon systems. In total, AAM predicted 266.9 (995.5-728.6) more available aircraft than the current system. This doesn't mean the Air Force will actually have 266.9 more mission capable aircraft compared to today. AAM doesn't consider a number of workarounds such as cannibalization and lateral resupply between bases. However, we can safely say AAM is a significant improvement over VSL.

We did our analysis off-line, working from printouts of the cost-versus-availability tables. We wanted to compare actual AAM computed results to our predicted results. So, we set the input AAM weapon system targets

according to our analysis and ran the model. For each of the twenty weapon systems we studied, the actual AAM computation results agreed closely with our predictions. For the airlift aircraft grouping, AAM actually computed the availabilities and costs as shown in Table 2-5. Appendix A contains results for all twenty of the weapon systems in our analysis.

FULL FUNDING TARGETS

Appendix A shows AAM will significantly improve Air Force weapon system availability readiness position for the same cost as the current system. Recall we started our analysis with the Air Staff guidance to define the full funding requirements so that the total AAM costs equal today's VSL costs. In June 1988 AAM will replace VSL for aircraft spares and we will no longer have a VSL "target" budget to determine AAM full funding requirements. How should we define AAM full funding requirements for the future?

We took another look at the optimal availabilities from our analysis and computed an average Air Force aircraft availability. This was equal to the sum of available aircraft for each weapon system (weapon system fleet size times weapon system availability percent) divided by the sum of the weapon system fleet sizes. We found AAM will achieve an average aircraft availability of 84.7 percent using the optimal targets. On the other hand, VSL only achieved an average availability of 66.4 percent.

This doesn't mean every unit should expect to have an 84.7 percent mission capability rate under AAM. However, we can again safely say the 84.7 percent figure represents an improvement over VSL.

We recommend the Air Force continue to use 84.7 percent average aircraft availability as the full funding objective for the AAM requirements computation. We can use the procedures we've already described to optimally allocate dollars to achieve the 84.7 percent objective. Instead of constraining the optimization to allocate the same total dollars as VSL, we constrain AAM to achieving an average of 84.7 percent aircraft availability.

DOLLAR-CONSTRAINED TARGETS

We should set full funding requirements optimally to achieve an objective Air Force average aircraft availability. **On the other hand, dollar-constrained execution must be based on available dollars.** The dollar-constrained optimization problem is almost the same as the full funding problem. The difference is in constraining the problem to a total budget instead of to an average 84.7 percent aircraft availability.

DISADVANTAGES OF THE MANUAL TARGET SETTING PROCESS

Though the concept is sound, there are several problems with these manual procedures to set weapon system targets.

a. Extracting the cost-versus-availability data from the mainframe computer is labor intensive. Also, the tables we've been using are from the AAM analysis model on CREATE and not from the actual production system. We need to automate a feed of the cost-versus-availability data from the mainframe production system to floppy disk.

b. For marginal analysis to work properly, as we allocate more money to a weapon system we must have decreasing marginal gains in available aircraft per dollar. In our analysis, we used discrete cost-versus-availability data points to determine the marginal tradeoffs. These discrete points weren't "smooth," making the tradeoffs unstable or imprecise at certain points. A "dumb" computer program might not handle this situation well. A solution is to fit each weapon system curve with a smooth polynomial function. Using a curve-fitting program, we achieved excellent fits using sophisticated (cubic polynomial) functions.

c. To perform the marginal analysis tradeoff, we used our MICROSOFT PC FORTRAN program to generate hard copy printouts of each weapon system's marginal gain in aircraft per dollar. We manually compared the printout data to determine reallocation amounts and used the program to resummairize the total costs after each reallocation. We need to automate this logic. Automation is crucial for this technique to be a useful tool to AFLC budget managers.

After some additional analysis, we determined how to automate the optimization problem.

AUTOMATING THE TARGET SETTING PROCESS

We've developed prototype software for automating the weapon system tradeoff. The prototype currently consists of two parts: a polynomial curve fit which "smooths" the discrete data and an algorithm which optimally reallocates dollars using an optimization (Lagrange multiplier) technique.

The polynomial curve fitting algorithm takes the discrete cost-versus-availability data and finds the least squares fit curve (cubic polynomial). The solutions are not too difficult to compute and appear well-behaved over the range of interest (approximately 65 percent to 95 percent availability). We verified these results using a second curve fitting program.

The optimization algorithm (Lagrange problem) is capable of solving two separate cases: one constrained by a dollar target and one constrained by an average Air Force availability target. In this study, our original goal was to solve the first (dollar-constrained) case. In this case the algorithm maximizes the number of available aircraft subject to the following constraints:

a. The solution must allocate an amount specified as a limited funding budget.

b. Each weapon system has a lower bound availability or budget. We used 75 percent availability in our study.

c. Each weapon system has an upper bound availability or budget. We used 90 percent availability in our study.

The automated algorithm first looks for a feasible point which satisfies all of the constraints, then maximizes available aircraft while keeping the total dollars constant. The algorithm will always find a feasible point when the target budget is bounded above by the sum of the individual weapon system upper bound costs and bounded below by the sum of the individual lower bound costs.

In the second optimization case the algorithm minimizes costs subject to the following constraints:

a. The solution must achieve an Air Force average 84.7 percent availability.

b. Each weapon system has a lower bound availability or budget (e.g., 75 percent availability).

c. Each weapon system has an upper bound availability or budget (e.g., 90 percent availability).

Again, the algorithm finds a feasible point which satisfies all of the constraints, then minimizes the budget while keeping the average availability constant. One feasible point is to set each individual weapon system availability to 84.7 percent.

Our new automated algorithm produced optimal points identical to those reached by hand in our earlier analysis. This validated our previous results and verified the program logic of our automated algorithm.

AUTOMATED ALGORITHM ADVANTAGES

There are many advantages to our automated approach:

a. There's no restriction on which weapon systems to group together for the optimization problem.

b. The polynomial smoothing algorithm keeps the tradeoff stable and well-defined. This also makes the optimization problem much more efficient by not having to store the discrete data points in an array for each weapon system. Each smooth polynomial curve requires storage of only four parameters.

c. We can constrain availabilities or budgets for individual weapon systems and constrain the total cost or average availability for weapon system groups.

d. We can "weight" individual weapon systems in the tradeoff. For example, suppose Air Force planners decide a C-5 is worth 15 C-130s in the optimal tradeoff. We could select weighting factors so that the model would reallocate money from the C-5 to the C-130 only if "giving up" an available C-5 would "gain" 15 more available C-130s. The weights can be based on some measure of mission impact. Our algorithm currently uses equal weights. **We need to study appropriate methods for setting these weights to values other than 1.**

e. Our algorithm provides several analysis products whereby we can identify the most sensitive constraint. This might be an individual availability/budget ceiling or floor or the total cost constraint. The most sensitive constraint is the one which yields the largest marginal increase in available aircraft by "relaxing" that constraint.

f. The algorithm logic can be applied to higher levels, such as between weapon system groups (e.g., tactical versus strategic). We could determine initial allocations between groups and use the optimization logic to reallocate dollars among the groups while holding the total cost constant.

IMPLEMENTATION ISSUES

We've briefed this methodology to the Air Staff and to the MAJCOM LG and LGS communities. They've agreed with our analysis and with the weapon system availability targets we developed (see Appendix A).

In order to implement our automated system to optimize AAM weapon system availability targets, we need to address several issues:

a. We need to automate downloading the cost-versus-availability tables from the production AAM to floppy disk. Without this capability, we'll be obliged to use HQ AFLC/XPSC data from CREATE or we'll be forced to do the optimization completely by hand from hardcopy printouts.

b. We need to modify the optimization algorithm into something which is user-friendly to the budget managers. We shouldn't eliminate assistance from the analysis community during the target-setting process, but we do need a package which is easy to use.

c. Our analysis only considered tradeoffs between weapon systems within functional groupings (tactical, bomber/tanker, airlift, and trainers). In other words, for a given group, we kept the total dollars constant and then maximized aircraft availability within the group (subject to constraints we discussed earlier in the chapter). Our automated model provides information to look at tradeoffs between the groupings as well. For example, we can estimate the aircraft availability impact of reallocating money from the tactical grouping to the bomber/tanker grouping or vice-versa. We should investigate impacts of dollar reallocations among the weapon system groups. We should involve AFLC budget managers and the LOC in this analysis.

d. We should investigate using a similar optimization algorithm to determine weapon system targets to compute dollar-constrained buy levels for War Readiness Spares Kits (WRSK) and Base Level Self-Sufficiency Spares (BLSS). The Weapon System Management Information System Requirements/Execution Availability Logistics Module (WSMIS/REALM) could generate cost-versus-available aircraft tables for each WRSK and BLSS. We could then optimize limited war funds allocations among the WRSK and BLSS by weapon system or by groupings of kits (kits in theater, first to deploy, etc.) or by individual WRSK and BLSS. The determination of how to set targets will be based on the Air Staff prioritization scheme currently in work. The point is our optimization methodology must be modified to match the Air Force method of prioritizing warfighting units.

e. We should investigate using a similar optimization algorithm to determine limited funding buy levels for Other War Reserve Materiel (OWRM). D041 still computes OWRM using the VSL model. The Requirements Data Bank (RDB) will use AAM to compute OWRM and will provide cost-versus-availability data. When this data is available, we could optimize funds allocations for OWRM.

One final note: Our analysis only dealt with 20 major weapon systems which account for 98 percent of today's AAM costs. We excluded the remaining smaller weapon systems because the dollars are too small to make a difference in the optimization. We currently use 90 percent as the availability target for these smaller systems.

Chapter 3

CONCLUSIONS AND ACTIONS

CONCLUSIONS

1. The Aircraft Availability Model (AAM) optimizes spares requirements to achieve target weapon system availabilities at the least cost. It also relates dollars to readiness and accounts for the impact of common items.
2. We've programmed a methodology that sets weapon system targets which achieve aircraft availability targets at least equal to today's availabilities, maximizes the number of aircraft by weapon system category (tactical, bomber/tanker, airlift, and trainers), and does not drastically alter the allocation of dollars under the current Variable Safety Level (VSL) computation.
3. We can achieve 84.7 percent average aircraft availability with AAM for the same cost to achieve 66.4 percent average aircraft availability with VSL.
4. We can automate the methodology for determining optimal weapon system availability targets for both full funding and dollar-constrained computations.
5. We've briefed the major commands on our proposed methodology to set weapon system targets and they agree with our approach.

ACTIONS

1. Implement the Aircraft Availability Model (AAM) to compute peacetime requirements for aircraft replenishment spares. (OPR: HQ AFLC/MMMR)
2. Use the AAM weapon system availability targets specified in Appendix A of this report for the June 1988 AAM computation. (OPR: HQ AFLC/MM)
3. Automate down loading cost-versus-availability tables from the AAM production system. (OPR: AFLC LMSC/SMP, OCR: HQ AFLC/MMMR)
4. Implement the personal computer-based system for determining optimal weapon system availability targets. (OPR: HQ AFLC/MMM(3), OCR: HQ AFLC/MMMA)
5. Use our methodology to determine dollar-constrained weapon system targets. OPR: HQ AFLC/MMM(2), OCR: HQ AFLC/MMMA)
6. Investigate using our optimization methodology to determine War Readiness Spares Kit (WRSK) and Base Level Self-Sufficiency Spares (BLSS) limited funding targets. OPR: HQ AFLC/MMMA, OCR: HQ AFLC/MMM(2)/MMM(3))
7. Investigate using our optimization methodology to determine Other War Reserve Materiel (OWRM) limited funding weapon system targets. (OPR: HQ AFLC/MMM(4), OCR: HQ AFLC/MMM(2)/MMM(3))
8. Investigate appropriate methods for weighing weapon systems in the optimization tradeoffs. (OPR: HQ AFLC/MMMA)

APPENDIX A
ANALYSIS RESULTS

Appendix A

ANALYSIS RESULTS

OVERVIEW

In this Appendix we include several tables comparing the Variable Safety Level model (VSL) to the Aircraft Availability Model (AAM). We used scrubbed data from the March 1987 computation cycle of the Recoverable Consumption Item Requirements System (DO41) to develop these tables. Table A-1 is a breakout of buy requirements for Peacetime Operating Stocks (POS), War Readiness Spares Kits (WRSK)/Base Level Self-Sufficiency Spares (BLSS), and Other War Reserve Material (OWRM). This table shows the total dollar allocations under AAM will nearly equal the VSL model (only the mix of items will be different).

AIRCRAFT AVAILABILITY RESULTS BUY REQUIREMENT (\$ BILLIONS)

	<u>POS</u>	<u>WRSK/BLSS</u>	<u>OWRM</u>	<u>Total</u>
VSL	\$2.9	\$2.0	\$3.0	\$7.9
AAM	\$2.8	\$2.0	\$2.9	\$7.7

Table A-1

Table A-2 shows AAM will increase the first year repair requirement for aircraft replenishment spares by about \$23 million over VSL.

AIRCRAFT AVAILABILITY REPAIR REQUIREMENTS (\$ MILLIONS)

VSL	\$481.8M
AAM	\$505.0M

Table A-2

Tables A-3 thru A-6 compare VSL to AAM for each of the four weapon system groupings (tactical, bomber/tanker, airlift, and trainers). For each weapon system we show the VSL cost, the achieved availability using the VSL-computed item mix, the AAM cost, and the achieved availability using the AAM-computed item mix. The AAM weapon system availabilities in Table A-3 through A-6 are the ones we derived from the methodology we described in the report. These are the targets to use in June 1988. We applied the VSL and AAM predicted availabilities to the weapon system fleet sizes to estimate the increase in available aircraft under AAM.

OPTIMAL AIRCRAFT AVAILABILITY RESULTS
TACTICAL WEAPON SYSTEMS

<u>A/C MD</u>	<u>VSL</u>		<u>AAM</u>		<u>Aircraft Increase Over VSL</u>
	<u>Cost (\$M)</u>	<u>Avail</u>	<u>Cost (\$M)</u>	<u>Avail</u>	
A-7	118.9	79.5	105.5	82.7	10.4
A-10	136.5	89.4	119.8	90.0	3.5
E-3	231.8	48.5	228.9	82.5	9.9
F-4	333.0	61.5	314.5	82.5	215.5
F-5	12.8	82.7	11.7	85.4	2.4
F-15	857.2	66.3	797.4	82.5	120.6
F-16	158.0	71.3	150.4	86.5	93.5
F-16C	604.8	68.5	557.7	82.5	78.9
F111	644.0	41.0	643.4	81.5	97.6
EF111A	106.4	47.1	102.7	82.7	12.8
FB111A	97.1	37.2	93.6	83.0	22.4
Total					667.5

Table A-3

OPTIMAL AIRCRAFT AVAILABILITY RESULTS
BOMBER/TANKER WEAPON SYSTEMS

<u>A/C MD</u>	<u>VSL</u>		<u>AAM</u>		<u>Aircraft Increase Over VSL</u>
	<u>Cost (\$M)</u>	<u>Avail</u>	<u>Cost (\$M)</u>	<u>Avail</u>	
B1	1631.1	4.5	1656.1	75.5	63.5
B52G	515.3	15.6	582.3	85.5	104.9
B52H	506.7	9.1	532.6	80.0	59.6
C135	203.8	63.8	209.0	90.0	143.1
KC135R	385.7	18.5	407.5	88.0	93.2
Total					464.1

Table A-4

OPTIMAL AIRCRAFT AVAILABILITY RESULTS
AIRLIFT WEAPON SYSTEMS

<u>A/C MD</u>	<u>VSL</u>		<u>AAM</u>		<u>Aircraft Increase Over VSL</u>
	<u>Cost (\$M)</u>	<u>Avail</u>	<u>Cost (\$M)</u>	<u>Avail</u>	
C5	687.3	38.3	699.0	75.0	41.8
C130	288.4	75.1	291.1	89.5	110.9
C141	250.2	42.6	269.0	87.5	114.0
Total					266.8

Table A-5

OPTIMAL AIRCRAFT AVAILABILITY RESULTS
TRAINERS

<u>A/C MD</u>	<u>VSL</u>		<u>AAM</u>		<u>Aircraft Increase Over VSL</u>
	<u>Cost (\$M)</u>	<u>Avail</u>	<u>Cost (\$M)</u>	<u>Avail</u>	
T38	34.9	92.6	30.2	93.0	3.0

Table A-6